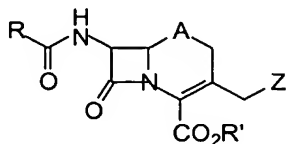


WHAT IS CLAIMED IS:

1. A compound having the general formula:

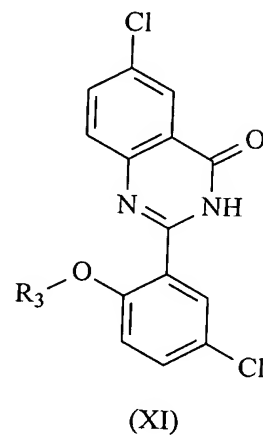
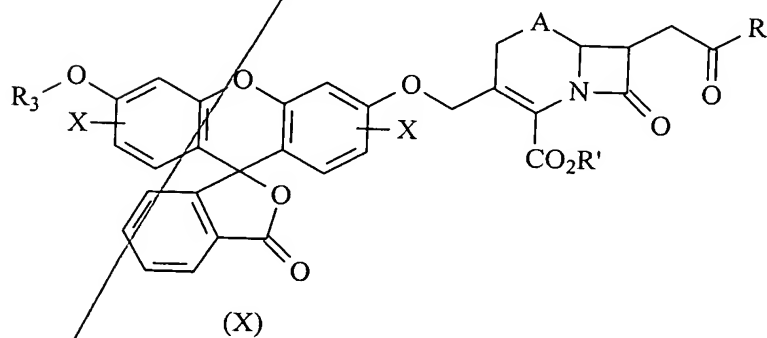
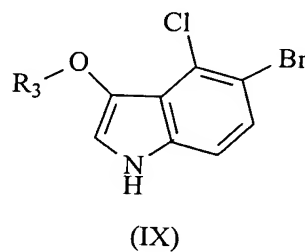
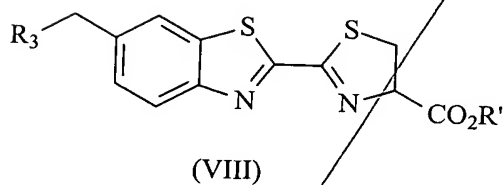
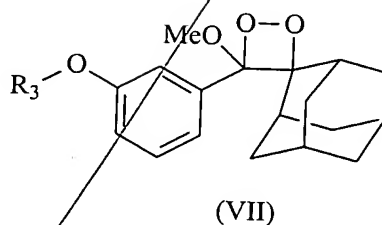
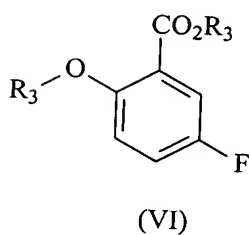
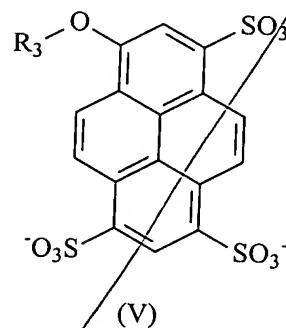
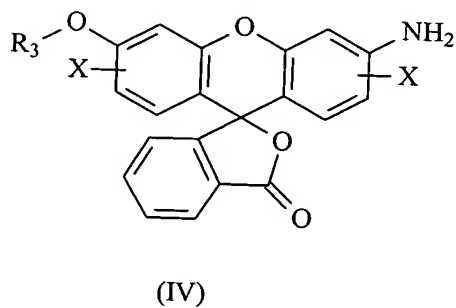
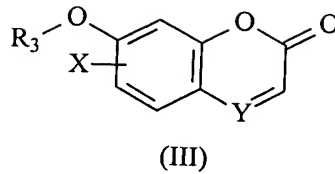
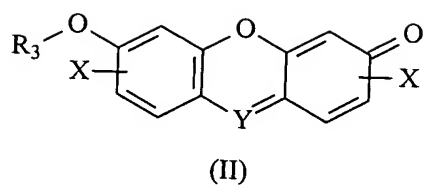


(I)

in which R is a benzyl, 2-thienylmethyl, or cyanomethyl group; R' is selected from the group consisting of H, physiologically acceptable salts or metal, ester groups, ammonium cations, --CHR<sub>2</sub>OCO(CH<sub>2</sub>)<sub>n</sub>CH<sub>3</sub>, --CHR<sub>2</sub>OCOC(CH<sub>3</sub>)<sub>3</sub>, acylthiomethyl, acyloxy-alpha-benzyl, deltabutyrolactonyl, methoxycarbonyloxymethyl, phenyl, methylsulphinylmethyl, β-morpholinoethyl, dialkylaminoethyl, and dialkylaminocarbonyloxymethyl, in which R<sub>2</sub> is selected from the group consisting of H and lower alkyl; A is selected from the group consisting of S, O, SO, SO<sub>2</sub> and CH<sub>2</sub>; and Z is a donor fluorescent moiety.

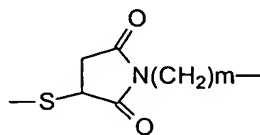
2. The compound of claim 1, wherein the donor fluorescent moiety is selected from the group consisting of:

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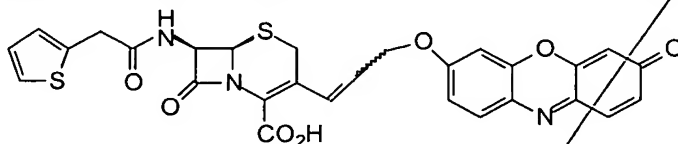
$R_3$  is a linker for the fluorescent donor.

3. The compound of claim 2, wherein the linker is selected from the group consisting of a direct bond to a heteroatom in the fluorescent moiety,  $--O(CH_2)_n--$ ,  $--S(CH_2)_n--$ ,  $--NR_2(CH_2)_n--$ ,  $--N^+R_2(CH_2)_n--$ ,  $--OCONR_2(CH_2)_n--$ ,  $--O_2C(CH_2)_n--$ ,  $--SCSNR_2(CH_2)_n--$ ,  $--SCSO(CH_2)_n--$ ,  $--S(CH_2)_nCONR_2(CH_2)_m--$ ,  $--S(CH_2)_nNR_2CO(CH_2)_m--$ , and

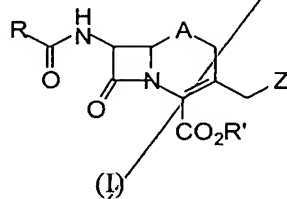


in which  $R_2$ ,  $n$  and  $m$  are as previously defined; and  $m$  is an integer from 0 to 4.

4. The compound of claim 1, wherein the compound has the structure:



5. A method for detecting the presence of  $\beta$ -lactamase activity in a sample, comprising: contacting the sample with at least one compound of general formula I:

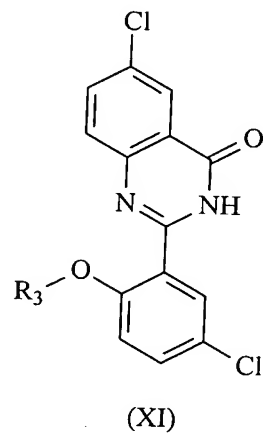
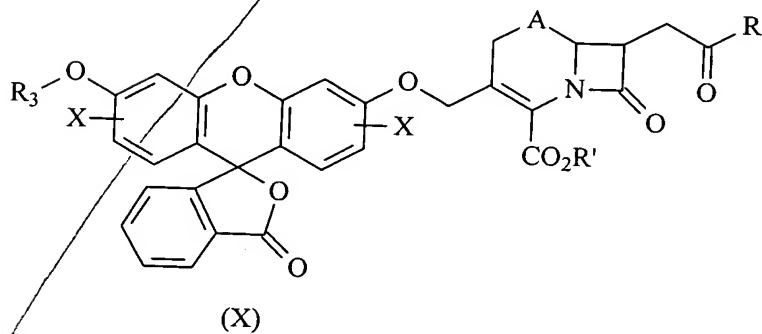
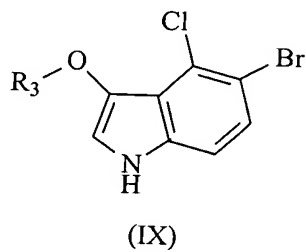
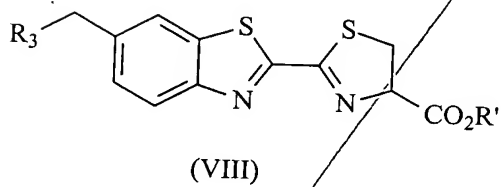
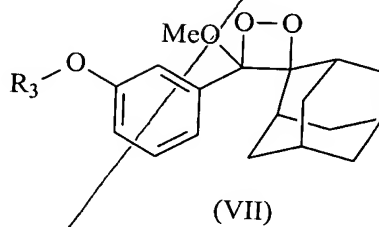
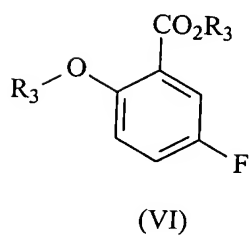
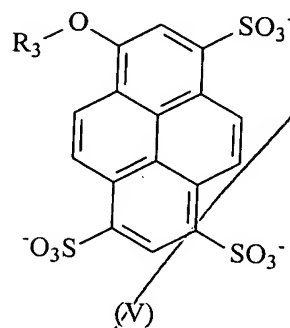
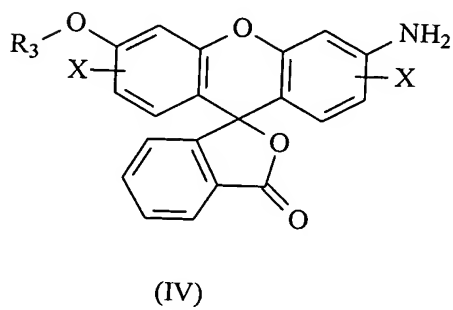
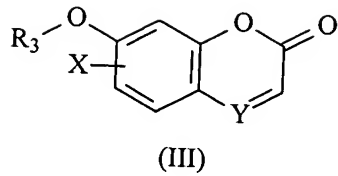
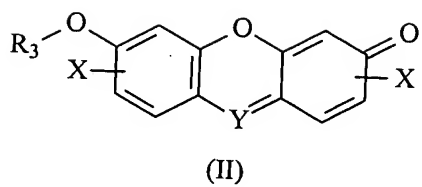


in which  $R$  is a benzyl, 2-thienylmethyl, or cyanomethyl group, or a quencher;  $R'$  is selected from the group consisting of H, physiologically acceptable salts or metal, ester groups, ammonium cations,  $--CHR_2OCO(CH_2)_nCH_3$ ,  $--CHR_2OCOC(CH_3)_3$ , acylthiomethyl, acyloxy-alpha-benzyl, deltabutyrolactonyl, methoxycarbonyloxymethyl, phenyl, methylsulphinylmethyl,  $\beta$ -morpholinoethyl, dialkylaminoethyl, and dialkylaminocarbonyloxymethyl, in which  $R_2$  is selected from the group consisting of H and lower alkyl;  $A$  is selected from the group consisting of S, O, SO,  $SO_2$  and  $CH_2$ ; and  $Z$  is a donor fluorescent moiety.

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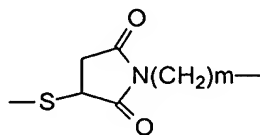
6. The method of claim 5, wherein said sample has a  $\beta$ -lactamase reporter gene.
7. The method of claim 6, wherein said  $\beta$ -lactamase reporter gene is in a mammalian cell.
8. The method of claim 5, wherein samples having  $\beta$ -lactamase activity are separated from samples having no  $\beta$ -lactamase activity by fluorescent-activated cell sorting.
9. The method of claim 5, wherein the  $\beta$ -lactamase activity results from a  $\beta$ -lactamase enzyme that was prepared by mutagenesis of another  $\beta$ -lactamase enzyme.
10. The method of claim 5, wherein said compound is a membrane permeant derivative.
11. The method of claim 5, wherein the donor fluorescent moiety is selected from the group consisting of:

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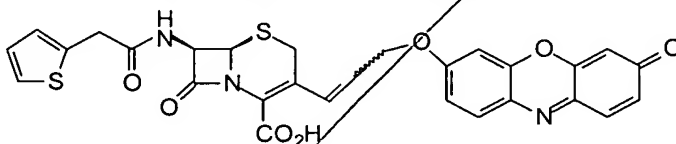
R<sub>3</sub> is a linker for the fluorescent donor.

12. The method of claim 11, wherein the linker is selected from the group consisting of a direct bond to a heteroatom in the fluorescent moiety, --O(CH<sub>2</sub>)<sub>n</sub>--, --S(CH<sub>2</sub>)<sub>n</sub>--, --NR<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>--, --N<sup>+</sup>R<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>--, --OCONR<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>--, --O<sub>2</sub>C(CH<sub>2</sub>)<sub>n</sub>--, --SCSNR<sub>2</sub>(CH<sub>2</sub>)<sub>n</sub>--, --SCSO(CH<sub>2</sub>)<sub>n</sub>--, --S(CH<sub>2</sub>)<sub>n</sub>CONR<sub>2</sub>(CH<sub>2</sub>)<sub>m</sub>--, --S(CH<sub>2</sub>)<sub>n</sub>NR<sub>2</sub>CO(CH<sub>2</sub>)<sub>m</sub>--, and



in which R<sub>2</sub>, n and m are as previously defined; and m is an integer from 0 to 4.

13. The method of claim 5, wherein the compound has the structure:



14. A method for determining whether a compound of claim 1 is a substrate for a  $\beta$ -lactamase enzyme, comprising: contacting said compound with a sample containing said  $\beta$ -lactamase enzyme; exciting at the wavelength for the said compound when cleaved; and measuring fluorescence.

15. The method of claim 14, wherein said compound is a membrane permeant derivative.

16. The method of claim 14, wherein said  $\beta$ -lactamase enzyme has been prepared by mutagenesis of another  $\beta$ -lactamase enzyme.